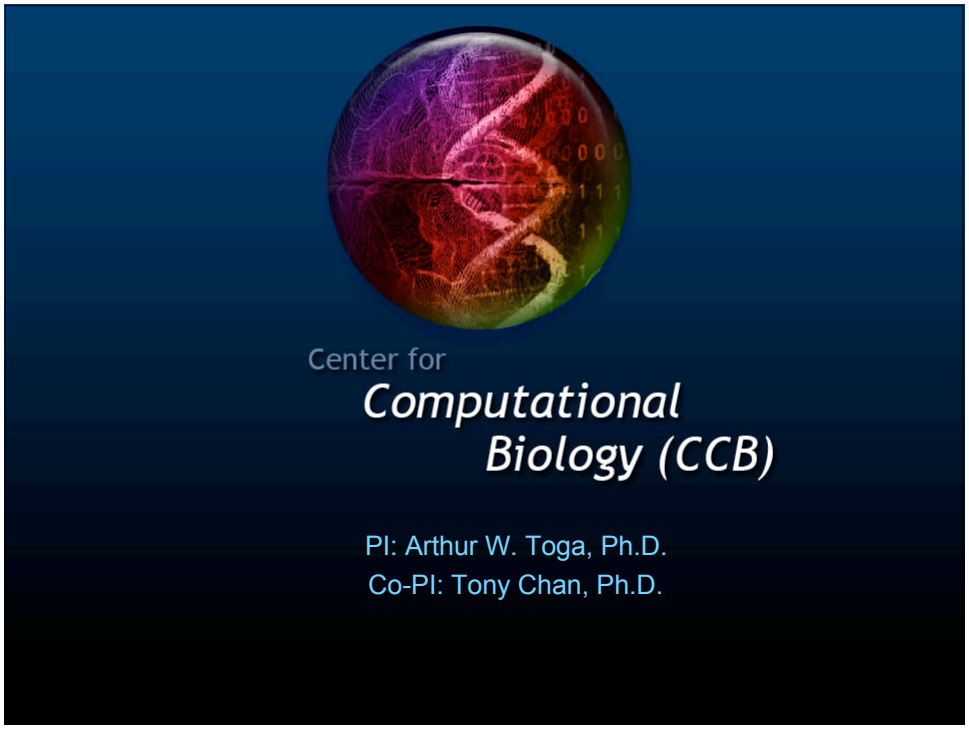
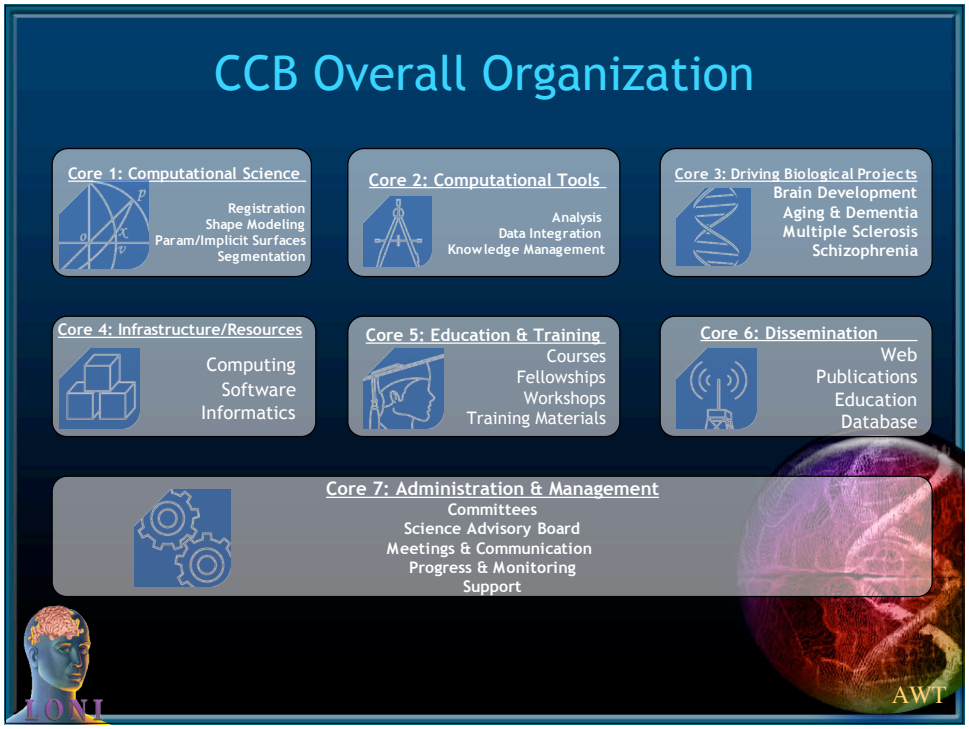

Center for
Computational
Biology (CCB)
PI: Arthur W. Toga, Ph.D.
Co-PI: Tony Chan, Ph.D.


CCB Overall Organization
Core 1: Computational Science
Registration
Shape Modeling
Param/Implicit Surfaces
Segmentation
Core 2: Computational Tools
Analysis
Data Integration
Knowledge Management
Core 3: Driving Biological Projects
Brain Development
Aging & Dementia
Multiple Sclerosis
Schizophrenia
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Meetings & Communication
Progress & Monitoring
Support
LONI
AWT

CCB Major Objectives

- Establish a new integrated multidisciplinary research center in **computational neurobiology**.
- Develop **Atlases** – sets of **maps** on different spheres of biological information that span many *resolution-scales, image-modalities*, *species*, *genotypes* & *phenotypes.*
- Introduce **new mathematical symbolic representations** of pertinent biological information across space & time.
- Develop, implement and test **computational tools** that are applicable across different biological systems & atlases.

CCB 2004 Accomplishments

- CCB COO on board (Ivo Dinov, Ph.D.)
- CCB Web – fully functional (general/CCB access)
- Joint Pubs – LONI/IPAM/Math/CS
  - –33 pubs, 3 book chapters, 34 abstracts, 7 proceedings (in PNAS, Nature Neuroscience, Nature Reviews)
- CCB Kickoff All-Day meeting 11/06/04
  - – Agenda, Minutes, Attendees, Deliverable, etc. posted online
- Summer Math of Biomed Imaging Workshop – LONI/IPAM
  - –2 weeks, 40 speakers, 200 attendees
  - –Published Proceedings (Elsevier, *NeuroImage*, Vol. 23, Supp. 1, 300 pgs, Oct. 2004)
- Recruited 3 postdocs, 4 grads & 2 undergrads in 2004

CCB Overall Organization
Core 1: Computational Science

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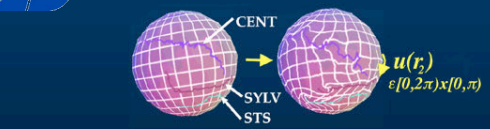
LONI TC

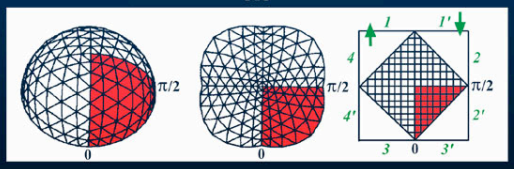
Core 1 Specific Aims

- Registration using Level Sets
- Modeling of Shape and Shape Analysis
- Parametric & Implicit Surface Models
- Volumetric Image Segmentation

LONI TC

Core 1: SA 1 – Covariant Matching

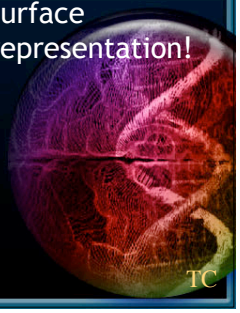




$$[(\lambda+\mu)\nabla(\nabla\bullet)+\mu\nabla^2]^*u(r_2)$$
$$+F(r_2-u(r_2))=0;\ u(r_2)=u_0(r_2)\ \text{if}\ r_2\varepsilon S_2$$
$$u^i_{,k}=\partial u^j/\partial r_2^k+\Gamma^j_{ik}u^i$$
$$\Gamma^i_{jk}=\tfrac{1}{2}g^{il}(\partial g_{lj}/\partial r_2^k+\partial g_{lk}/\partial r_2^j+\partial g_{jk}/\partial r_2^l)$$
$$[(\lambda+\mu)\nabla(\nabla\bullet)+\mu\nabla^2]^*u(r_1)$$
$$+F(r_1-u(r_1))=0;\ u(r_1)=0\ \text{if}\ r_1\varepsilon S_1$$

How to describe a surface deformation in math terms?

One Answer – use ***parametric*** surface representation!



TC

Core 1: SA 1

Find map u from M to N *minimizing*:

$$E[\vec{u}] \triangleq \int_{\mathcal{M}} e[\vec{u}]\, d_{\mathcal{M}}v \qquad e[\vec{u}] \triangleq \frac{1}{2}\|\mathbf{J}_{\vec{u}}\|_{\mathcal{F}}^2$$

Use $\|\cdot\|_{\mathcal{F}}^2 = \sum_{ij}(\cdot)_{ij}^2$

$\vec{u} : \mathcal{M} \to \{\psi = 0\}.$

$\mathbf{\Pi}_{\{\psi=0\}}(\vec{\alpha}) = \vec{\alpha} - \psi(\vec{\alpha})\ \nabla\psi(\vec{\alpha}).$

Harmonic Case:

$$e[\vec{u}](x) \triangleq \frac{1}{2}\, g^{pq}(x)\ h_{ij}(\vec{u}(x))\ \frac{\partial u^i}{\partial x_p}\frac{\partial u^j}{\partial x_q}.$$

E-L:

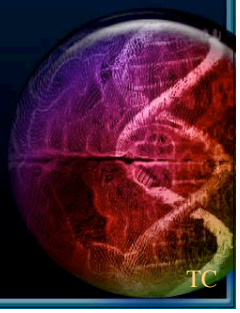
$$\Delta_{\mathcal{M}}u^i + \mathbf{\Gamma}^i_{ij}(\vec{u})\, g^{\alpha\beta}\frac{\partial u^i}{\partial x^\alpha}\frac{\partial u^j}{\partial x^\beta} = 0$$

Gradient Descent, Onto Level Set:

$$\frac{\partial u^i}{\partial t} = \Delta u^i + \sum_{k=1}^{d}\mathbf{H}_\psi(\vec{u})\left[\frac{\partial \vec{u}}{\partial x_k}, \frac{\partial \vec{u}}{\partial x_k}\right]\frac{\partial \psi}{\partial u^i}(\vec{u})$$

How to describe a surface deformation in math terms?

Another Answer – use ***implicit*** surface representation!



TC

Core 1: SA 2
Areas of investigation

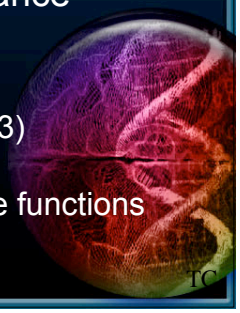
- *Shape representation:* current approaches have limitations, thorough experimental validation and comparison
- *Shape matching:* global integration computationally challenging
- *Deformation:* capturing phenomenology of shape despite deformations
- *Temporal* shape evolution

Shape representation

- Quotient Spaces (homogeneous space):
  - e.g. $\mathbb{R}^{3N}/SE(3)$ (procrustean metric)
  - (Euclidean, affine) curvature
- Local representations
  - Jacobian of diffeomorphic map to atlas [Woods]
- Integral/differential invariants [Soatto]
- Global representations (2-D)
  - Signed-distance functions [Chan]
  - Kernelized splines [Cremers]
  - Harmonic embedding [Soatto]

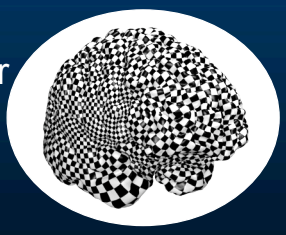
Statistical analysis of shape

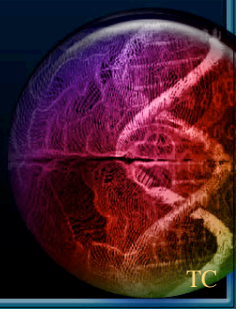
- Compute “mean” “covariance”
- Principal component analysis, linear discriminant analysis …
- Leventon-Grimson-Faugeras: “let us represent shape with a signed-distance function” (Eikonal equation)
- Problems:
  - Representation is non-linear after SE(3) quotiented out
  - Even without quotient, signed distance functions are NOT a linear space!



Core 1: SA 3
Surface & Volume Conformal Mapping

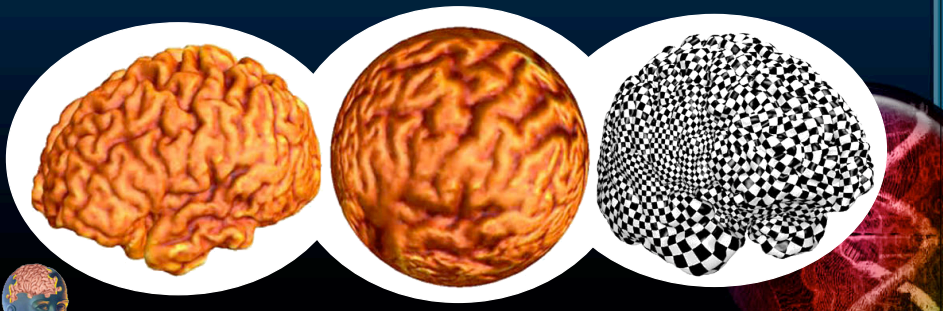
- Conformal Structure has been a central concept in mathematics for centuries
- A joint field of complex analysis, differential geometry, algebraic geometry.
- Compared to algebraic topology, differential topology and differential geometry, Conformal geometry theory has not been broadly applied in computer science.





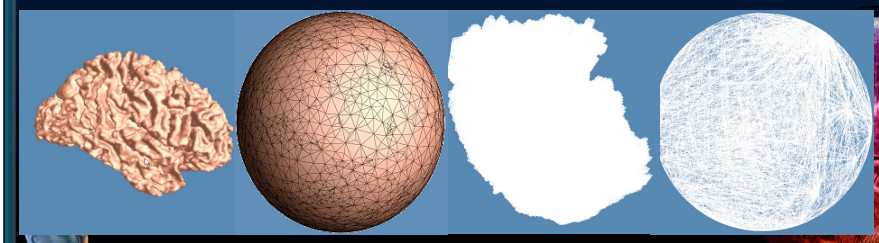
Conformal brain mapping

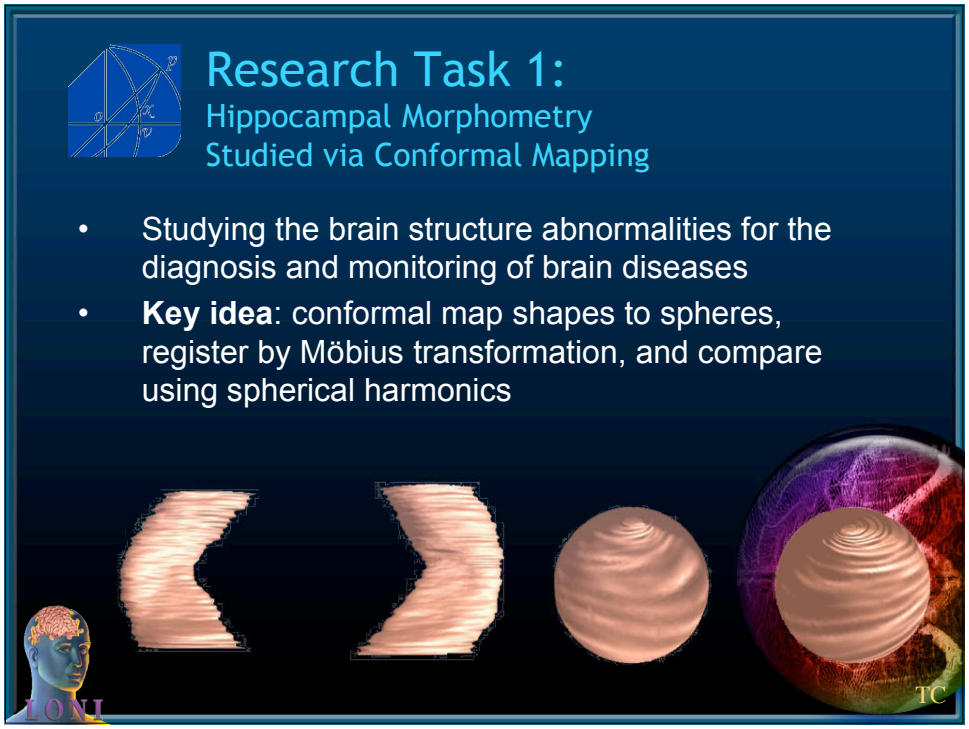
- We developed an intrinsic brain surface conformal mapping with a variational method.
  1. *X. Gu, Y. Wang, T. Chan, P. Thompson, and S.T. Yau, "*Genus Zero Surface Conformal Mapping and Its Application to Brain Surface Mapping", IEEE TMI 2004
  2. *Y. Wang, X. Gu, T. Chan, P. Thompson, and S.T. Yau,* "Intrinsic Brain Surface Conformal Mapping using a Variational Method", *SPIE 2004*

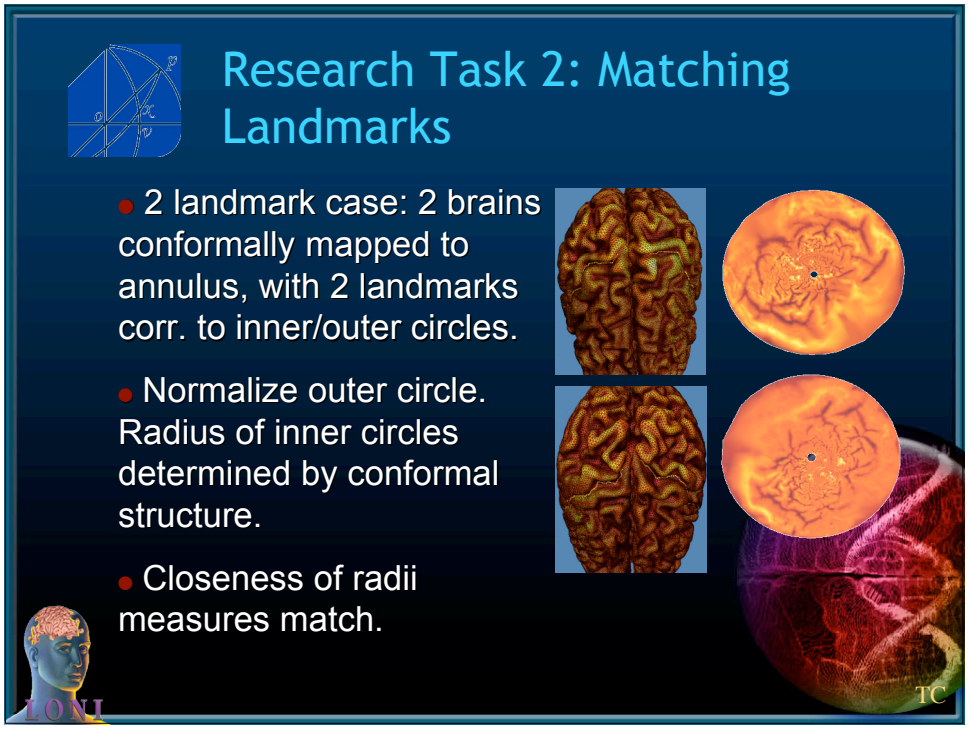


Volumetric Brain Harmonic Map

- We developed an algorithm to find a harmonic map from a 3 manifold to a 3D solid sphere.
- We also developed another technique, sphere carving algorithm, which calculates the simplicial decomposition of volume adapted to surfaces.
  - *Y. Wang, X. Gu, T. Chan, P. Thompson, and S.T. Yau, "*Volumetric Harmonic Brain Mapping", IEEE ISBI 2004




Research Task 1:
Hippocampal Morphometry
Studied via Conformal Mapping
• Studying the brain structure abnormalities for the diagnosis and monitoring of brain diseases
• **Key idea**: conformal map shapes to spheres, register by Möbius transformation, and compare using spherical harmonics
LONI
TC


Research Task 2: Matching Landmarks
• 2 landmark case: 2 brains conformally mapped to annulus, with 2 landmarks corr. to inner/outer circles.
• Normalize outer circle. Radius of inner circles determined by conformal structure.
• Closeness of radii measures match.
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TC

Core 1: SA 4: Image Segmentation

In Specific Aim 4 we seek to develop a set of mathematical techniques that will enable the development of brain image segmentation tools that are accurate and robust across diverse volumetric data sets.

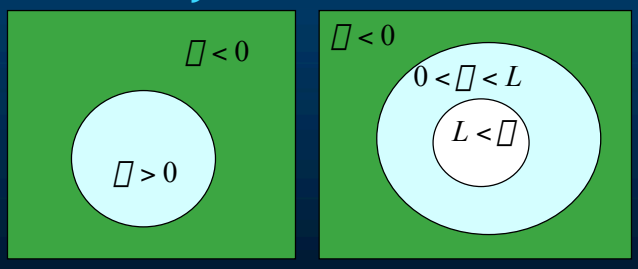
Tasks in SA 4

- Multi-layer Level Sets
- Logic Models using Level Sets
  - Segment multi-sequence images (e.g., MR T1-T2 sequences)
- Model-based Level Sets
  - Improved skull-stripping
  - Cortical thickness
- Particle-based techniques
  - Structure and vascular segmentation
  - Brain blood flow simulation
- Shape Priors

Multi-layer Level Sets

- Extend multi-layer models using more than one level line of a Lipschitz continuous function
- Potentially more efficient than Chan-Vese
- Captures the nested structures in the scene
- We can impose specific “anatomic” constraints
- May be suitable for measuring the thickness of the gray matter (2 nested level-lines needed)
- May be suitable for segmenting MS lesions in MR data

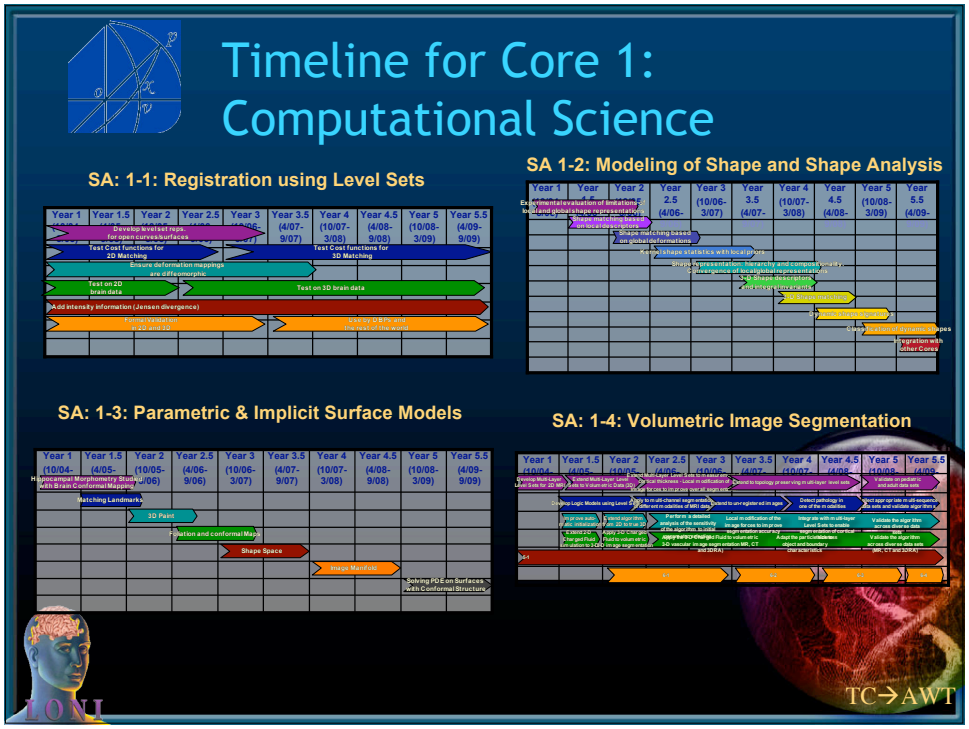
Multi-layer Level Sets

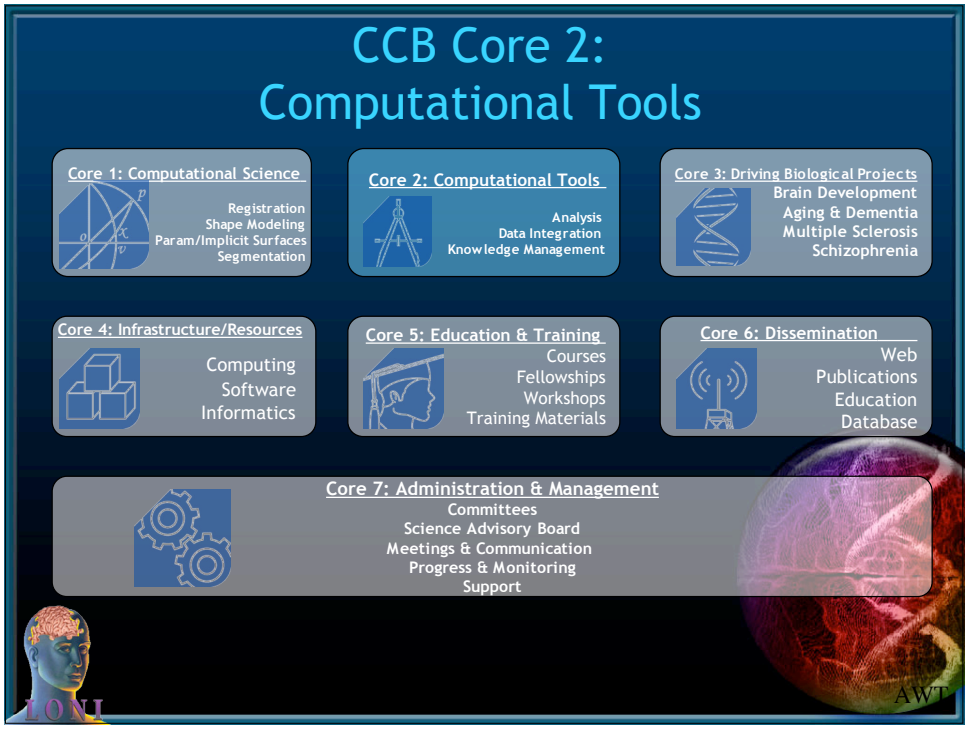


$$R_1 = \{x:\ \varphi(x) < 0\},\ R_2 = \{x:\ 0 < \varphi(x) < L\},\ R_3 = \{x:\ L < \varphi(x)\}$$

$$\inf_{c_1,c_2,c_3,\varphi} \int_\Omega |\, f(x) - c_1 \,|^2 H(-\varphi(x))dx + \int_\Omega |\, f(x) - c_2 \,|^2 H(\varphi(x))H(L - \varphi(x))dx$$

$$+ \int_\Omega |\, f(x) - c_3 \,|^2 H(\varphi(x) - l)dx + \mu \left[\int_\Omega |\nabla H(\varphi)| + \int_\Omega |\nabla H(\varphi - l)| \right]$$


Timeline for Core 1:
Computational Science
SA: 1-1: Registration using Level Sets
SA 1-2: Modeling of Shape and Shape Analysis
SA: 1-3: Parametric & Implicit Surface Models
SA: 1-4: Volumetric Image Segmentation
LONI
TC→AWT


CCB Core 2:
Computational Tools
Core 1: Computational Science
Registration
Shape Modeling
Param/Implicit Surfaces
Segmentation
Core 2: Computational Tools
Analysis
Data Integration
Knowledge Management
Core 3: Driving Biological Projects
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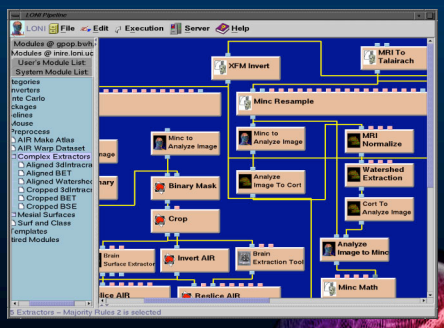
AWT

Core 2: Computational Tools Research Categories

- **Data Analysis**
  - Image segmentation
  - Surface methods
  - Diffusion Tensor Image Analysis
  - Biosequence analysis
- **Interaction**
  - Development of the LONI Pipeline Processing Environment
  - SCIRun/Pipeline integration
  - New tools for integrating, managing, modeling, and visualizing data
- **Knowledge Management**
  - Analytic strategy validation

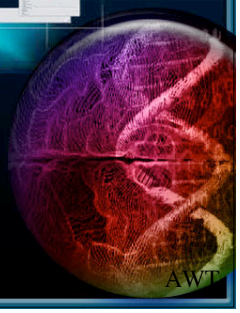
Core 2: Computational Tools Pipeline Development

- Architecture improvements
- Extend the Pipeline Processing Environment to incorporate SCIRun
- Grid engine integration
- Provenance integration
- Natural language interface



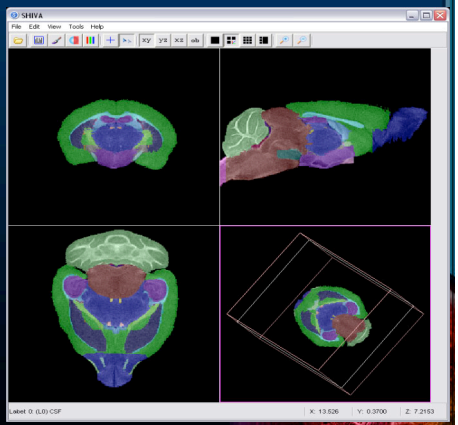
Core 2: Computational Tools Pipeline/SCI Run Integration

- Extend the SCIRun Environment to run the LONI Pipeline.
  - Compile LONI Pipeline with SCIRun2
  - Develop component model interface for LONI modules and components
- Develop bridging infrastructure to connect LONI to SCIRun
- Develop bridging infrastructure to connect LONI to ITK
- Enhance user interface to streamline working with LONI



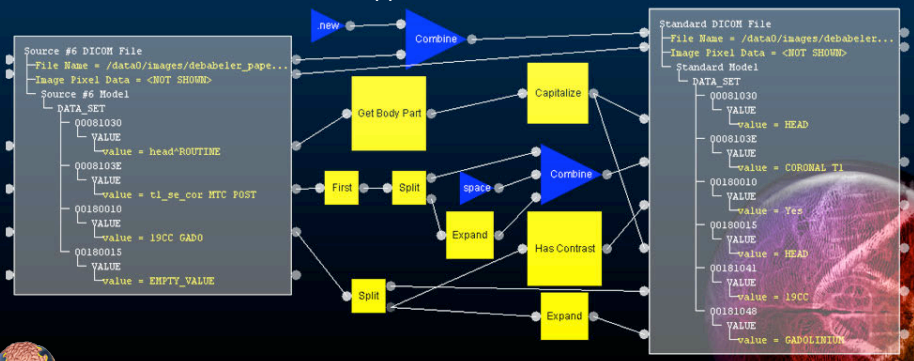
Core 2: Computational Tools Visualization: SHIVA

- Integrate command-line modules
  - Segmentation tools
  - Surface analysis tools
  - Registration tools
- Integration with Pipeline
- BrainGraph
- Brain Architecture Management System (BAMS) interface
- 3D Visualization
  - Surface models
  - DTI fiber tracts
  - Interactive sulcal tracing tool



Core 2: Computational Tools
Data Mediation

- Part of the LONI Debabeler
- Descriptors of data schema
- Automatically translate data into the formats required by individual applications



Debabeler Translation: this figure illustrates the translation of data acquired at a particular site for a research study into a format required for a different research study.

LONI

AWT

Core 2: Computational Tools
Data Provenance

- Data processing often occurs without an adequate record of what steps were performed.
  - Notes may be lost
  - Versions of programs may change
- A provenance system that will archive information about:
  - The nature of the data
  - Acquisition history
  - Processing history
- Provide Provenance query tools
- Provenance used by other tools to determine if input data are appropriate.

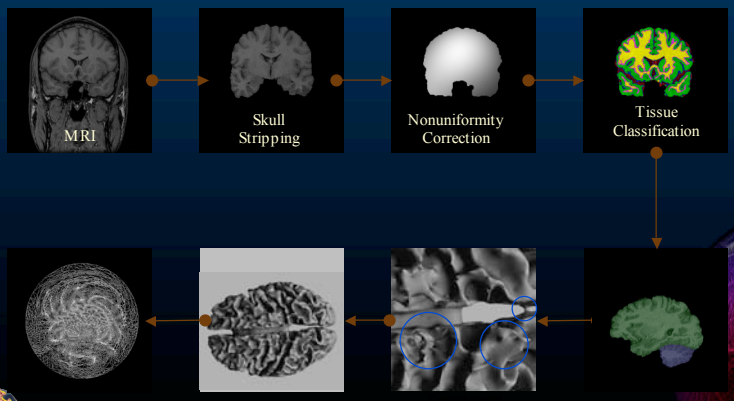
LONI

AWT→PT

Core 2: Computational Tools

Image analysis

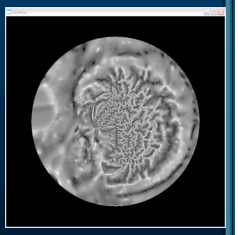
- Much of our work is based on 2D parameterized surfaces obtained from 3D MRI volumes.

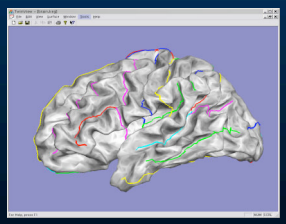


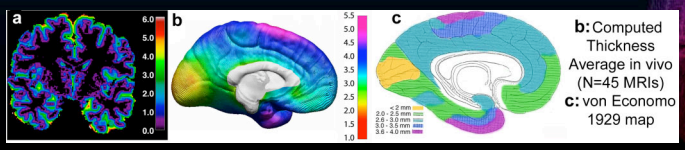
Core 2: Computational Tools

Surface Data Analysis

- Develop and validate methods for parameterizing zero-genus surfaces.
- Develop novel approaches for labeling cortical landmarks
- Develop new approaches for computing cortical thickness measures
  - Eikonal equations
  - Laplacian heat flows
  - Other PDE's.
  - Use either discrete and continuous tissue labels as source data





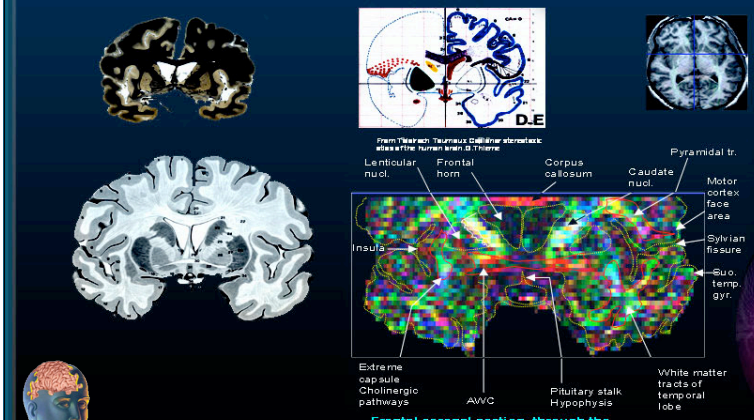


b: Computed Thickness Average in vivo (N=45 MRIs)
c: von Economo 1929 map

Core 2: Computational Tools

DTI Imaging

Correlation of histologic material with color encoded DTI image



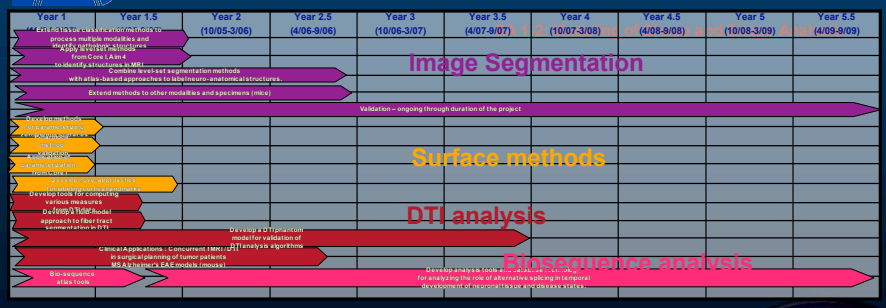
Frontal coronal section, through the anterior white commissure (AWC)

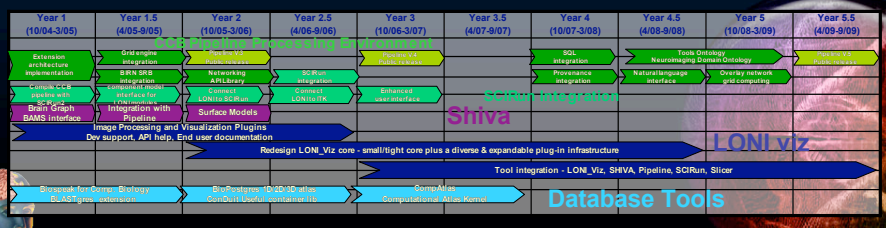
LONI

PT

Timeline for Core 2 :

Computational Tools

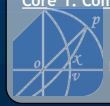




LONI

PT

CCB Core 3—DBP's

Core 1: Computational Science

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PT

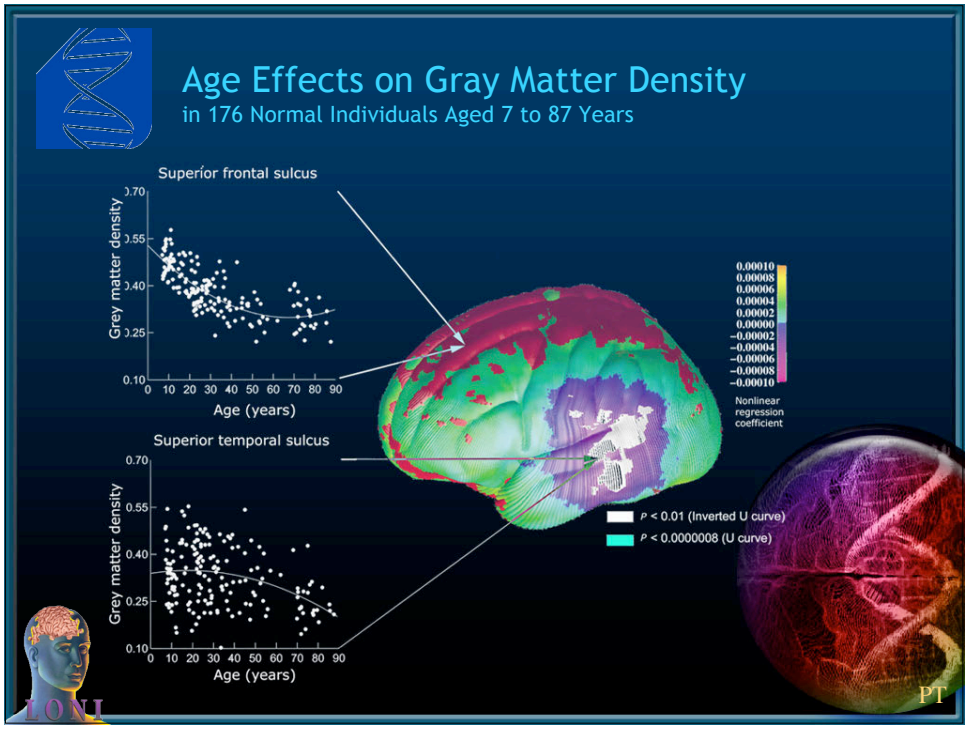
DBP 1:
Mapping Language Development Longitudinally

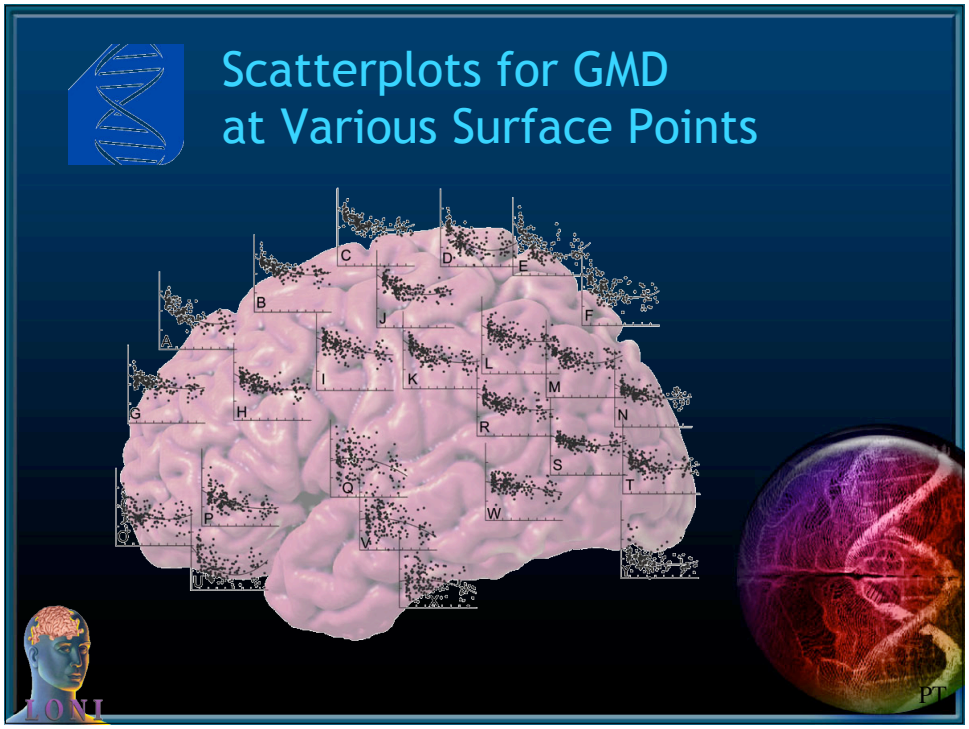
Specific Aim 1:
Quantify change in structure and functional signal within children studied longitudinally

Specific Aim 2:
Determine if change in functional signal is related to underlying brain structure

Specific Aim 3:
Relate behavioral language change to changes in brain structure and function

PT


Age Effects on Gray Matter Density
in 176 Normal Individuals Aged 7 to 87 Years
Superior frontal sulcus
Grey matter density
0.70
0.55
0.40
0.25
0.10
0 10 20 30 40 50 60 70 80 90
Age (years)
Superior temporal sulcus
Grey matter density
0.70
0.55
0.40
0.25
0.10
0 10 20 30 40 50 60 70 80 90
Age (years)
0.00010
0.00008
0.00006
0.00004
0.00002
0.00000
−0.00002
−0.00004
−0.00006
−0.00008
−0.00010
Nonlinear regression coefficient
P < 0.01 (Inverted U curve)
P < 0.0000008 (U curve)
LONI
PT


Scatterplots for GMD
at Various Surface Points
A
B
C
D
E
F
G
H
I
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V
W
LONI
PT

Comparing Activation Between Adults and Children

Adults

t

Children

PT

LONI

DBP 2: Aging & Dementia

Specific Aim 1:
Map Brain Change in Alzheimer's Disease with MRI

Specific Aim 2:
Map Cortical Surface Changes in Disease (AD, FTD)

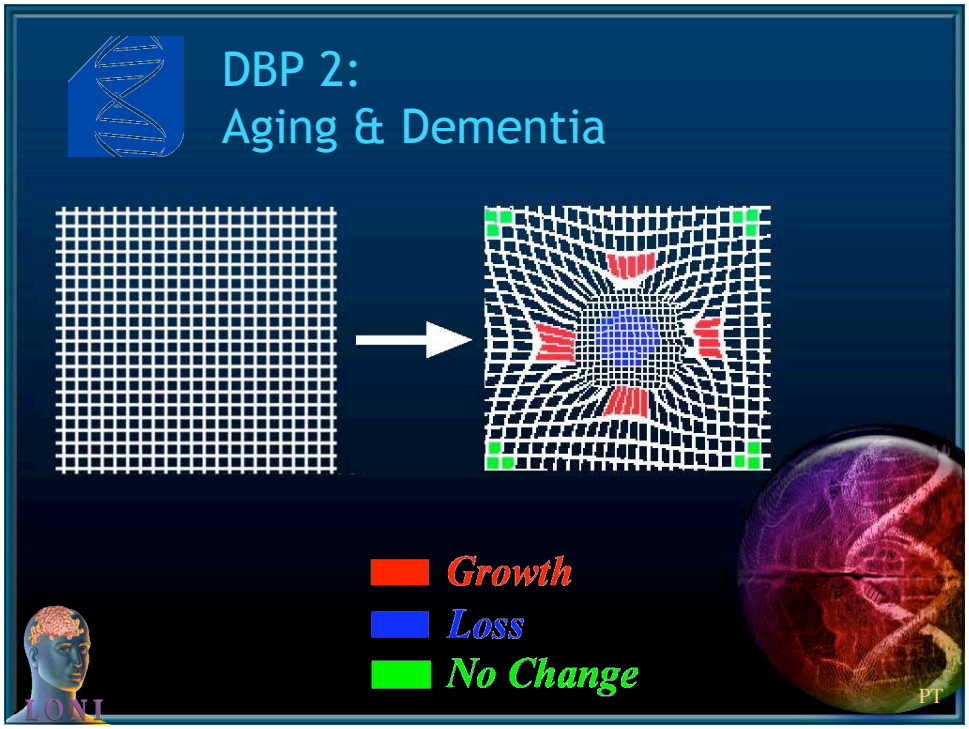
Specific Aim 3:
Analyze At-Risk Populations (MCI, ApoE)

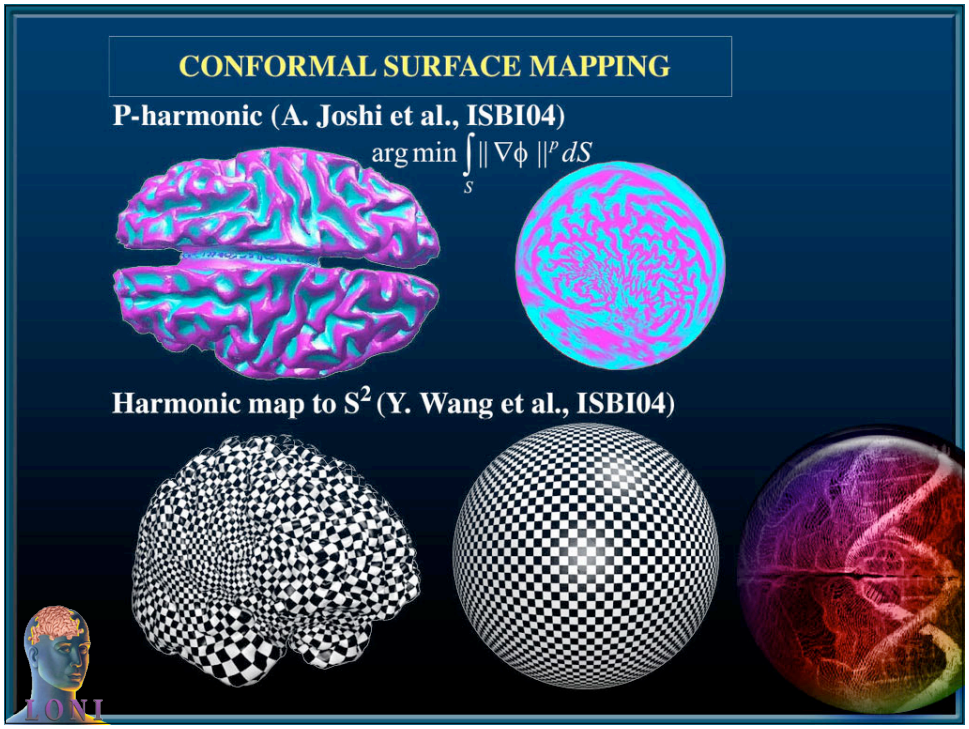
Specific Aim 4:
Correlate Structural & Functional Changes

Specific Aim 5:
Map Treatment Effects & Find Associations with Brain Changes

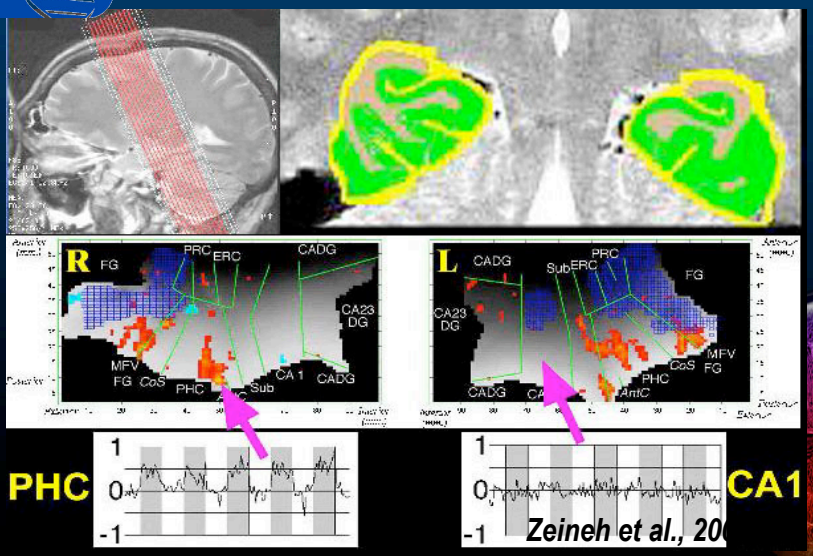
PT

LONI


DBP 2:
Aging & Dementia
Growth
Loss
No Change
LONI
PT


CONFORMAL SURFACE MAPPING
P-harmonic (A. Joshi et al., ISBI04)
$\arg\min \int_S \| \nabla\phi \|^p dS$
Harmonic map to S^2 (Y. Wang et al., ISBI04)
LONI

Core 3-2: Correlate with fMRI - Unfold the Hippocampus



PT

DBP 3: Multiple Sclerosis

Specific Aim 1: Determine the rate of structural change in white and gray matter as measured by MRI in RRMS patients either unlikely (early RRMS) or likely (late RRMS) to transition to SPMS.

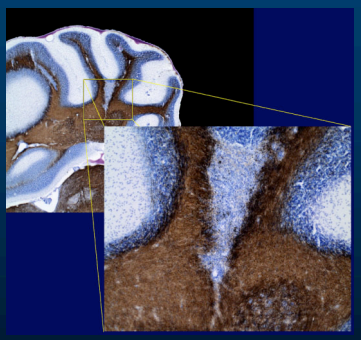
Specific Aim 2: Determine the rate of structural change in white & gray matter as measured by MRI in mice during early and late stages of EAE.

Specific Aim 3: Determine the anterograde and retrograde effects of EAE lesions on pathology during early and late stages of EAE.

LONI

PT

Aim 1

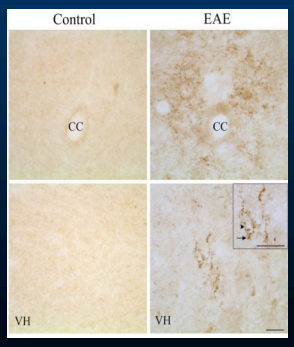


•Aim #1. Determine the rate of gray and white matter change with MRI in relapsing-remitting MS patients who transition to secondary progressive MS versus those who do not.

- 3 year longitudinal study, scanned every 6 months: 40 Late, 20 Early RRMS
- White matter: DTI (fA), lesions
- Gray matter: T1 volumes

(cortical, deep gray); clinical measures

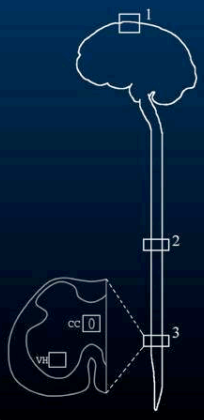
Aim 2



Aim #2. Determine the rate of gray and white matter change with MRI in mice during early and late stages of EAE.

- •EAE: longitudinal study (day 15, 40, 65)
- •15 EAE and 9 NLs (5 EAE and 3 NLs per group)
- •In vivo MRI, Ex vivo MRI, Ex vivo Pathology
- •White matter: DTI (fA), lesions
- •Gray matter: T2 volumes (cortical, deep gray)
- •Clinical scoring

Aim 3



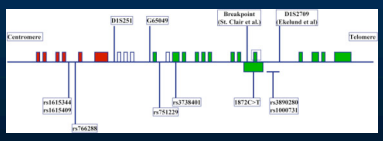
- **Aim #3. Determine the anterograde and retrograde effects of EAE lesions on pathology during early and late stages of EAE.**

- EAE: longitudinal study (day 15, 40, 65)
- 15 EAE and 9 NLs (5 EAE and 3 NLs per group)
- In vivo MRI, Ex vivo MRI, Ex vivo Pathology
- White matter: Wallerian degeneration, lesions
- Gray matter: neuro and oligo death, microglia
- Clinical scoring

LONI

PT

DBP 4: Schizophrenia

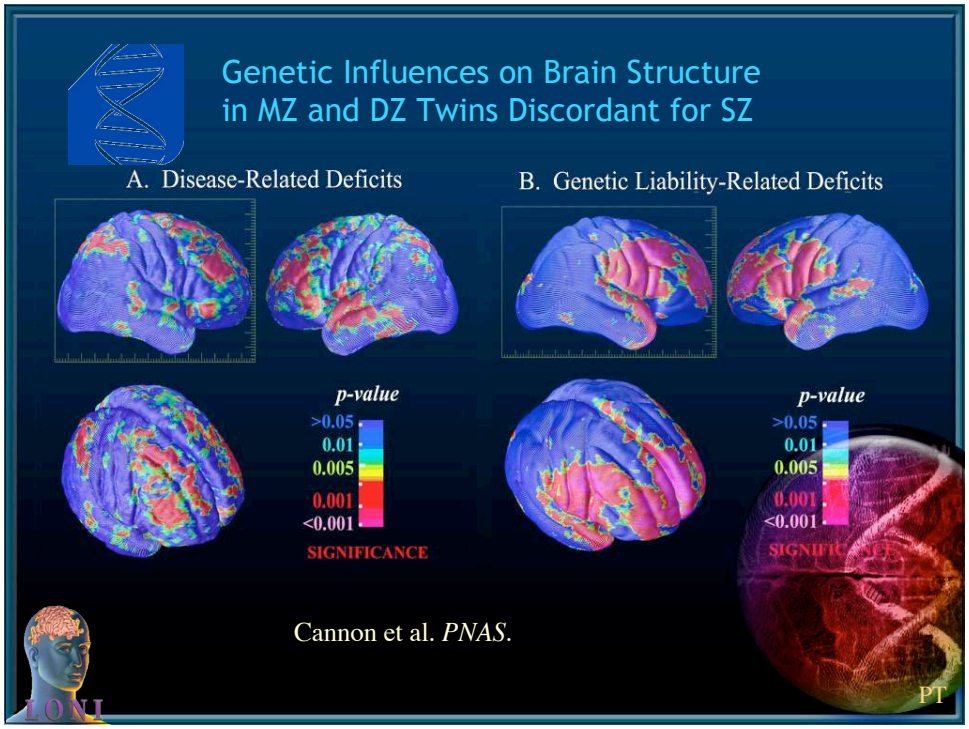


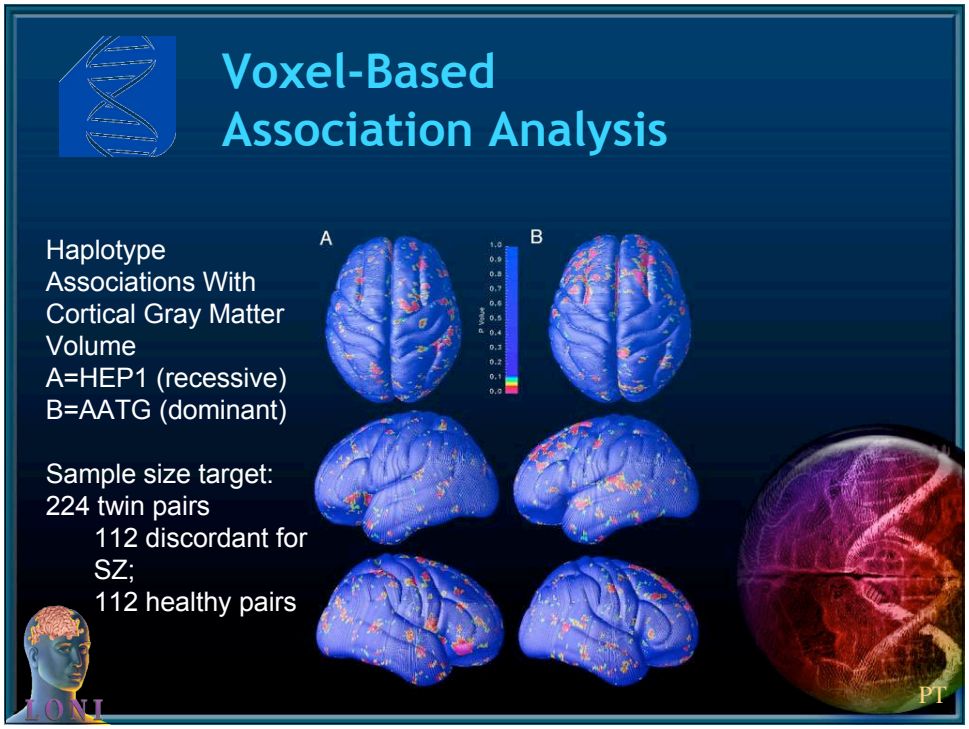
- Determine the heritable and non-heritable influences of schizophrenia on gray and white matter in twins

- Analyze & determine associations between putative susceptibility genes in schizophrenia and gray/white matter volumes.

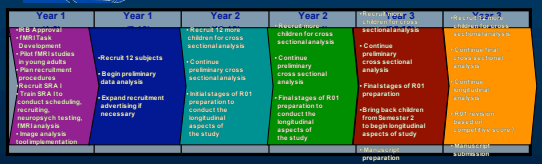
LONI

PT


Genetic Influences on Brain Structure
in MZ and DZ Twins Discordant for SZ
A. Disease-Related Deficits
B. Genetic Liability-Related Deficits
p-value
>0.05
0.01
0.005
0.001
<0.001
SIGNIFICANCE
p-value
>0.05
0.01
0.005
0.001
<0.001
Cannon et al. PNAS.
LONI
PT

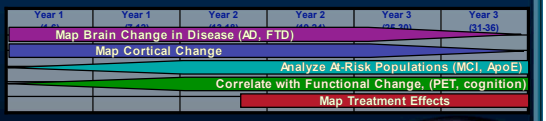

Voxel-Based
Association Analysis
Haplotype
Associations With
Cortical Gray Matter
Volume
A=HEP1 (recessive)
B=AATG (dominant)
Sample size target:
224 twin pairs
112 discordant for
SZ;
112 healthy pairs
A
B
LONI
PT

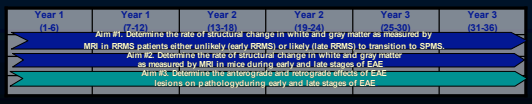
Timeline for Core 3
Driving Biological Projects



DBP 1: Mapping Language Development Longitudinally

DBP 2: Mapping Brain Change in Alzheimer's Disease





DBP 3: Multiple Sclerosis

DBP 4: Genetic Influences on Brain Structure in Schizophrenia

PT

CCB Overall Organization
Core 4: Infrastructure & Resources

Core 1: Computational Science
Registration
Shape Modeling
Param/Implicit Surfaces
Segmentation

Core 2: Computational Tools
Analysis
Data Integration
Knowledge Management

Core 3: Driving Biological Projects
Brain Development
Aging & Dementia
Multiple Sclerosis
Schizophrenia

Core 4: Infrastructure/Resources
Computing
Software
Informatics

Core 5: Education & Training
Courses
Fellowships
Workshops
Training Materials

Core 6: Dissemination
Web
Publications
Education
Database

Core 7: Administration & Management
Committees
Science Advisory Board
Meetings & Communication
Progress & Monitoring
Support

AWT

Specific Aims

SA-1: Computing Infrastructure

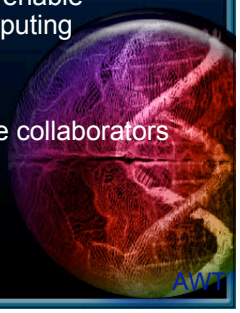
Develop, implement and maintain the computing resources and network services required for computationally intensive science performed in the CCB

SA-2: Application Deployment

Integrate the algorithms, techniques and tools developed in Cores 1 & 2 with the Computing Infrastructure to enable researchers to remotely access and use the computing resources of the CCB

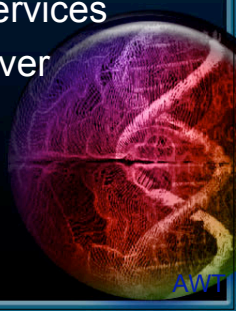
SA-3: Computational Research Support

Provide technical support and expertise to enable collaborators to use the resources of the CCB



SA 1: Computing Infrastructure

- Configure a supercomputing architecture, graphics server and visualization environment
- Configure distributed computing resources
- Configure Storage Area Network resources
- Implement and maintain network services
- Configure load balancing and fail-over

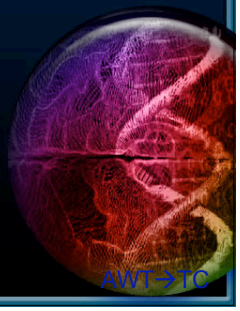


SA 2: Application Deployment

- LONI Distributed Information Architecture (LiDIA):
  - LONI Information Sharing Toolset (LIST)
  - LONI Information Storage Architecture (LISA)
  - LONI Atlas Information Server (LATIS)
- Integrate data storage with analysis (via the LONI Pipeline)
- Implement tools for visualizing biologic data
  - LONI Navigator
  - LONI Anatomist

SA 3: Computational Research Support

- Technical support
- Software engineering support
- Distribute tools and libraries



CCB Overall Organization
Core 5: Education & Training

Core 1: Computational Science
Registration
Shape Modeling
Param/Implicit Surfaces
Segmentation

Core 2: Computational Tools
Analysis
Data Integration
Knowledge Management

Core 3: Driving Biological Projects
Brain Development
Aging & Dementia
Multiple Sclerosis
Schizophrenia

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Computing
Software
Informatics

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Publications
Education
Database

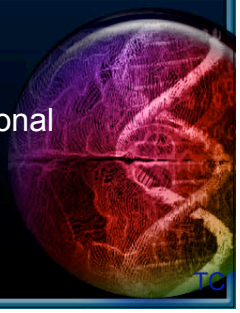
Core 7: Administration & Management
Committees
Science Advisory Board
Meetings & Communication
Progress & Monitoring
Support

Core 5: Specific Aims

- Coursework in imaging-based Computational Biology
- Graduate and undergraduate training in Computational Biology
- Fellowship Program
- Visiting Scholars Program
- Workshops, Retreats & Tutorials
- Educational Materials

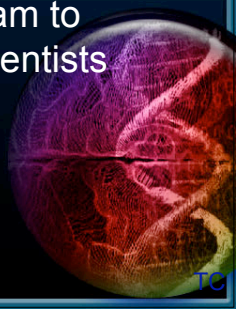
SA 1: Computational Biology Courses

- Survey existing coursework in affiliated programs:
  - Applied Mathematics
  - Bioengineering
  - Biomathematics
  - Biomedical Physics (Imaging Track)
  - Computer Science
  - Neuroscience
  - Statistics / Biostatistics
- With CCB faculty, identify needs for additional coursework



SA 2: Training in Computational Biology

- Establish computational bioimaging track in existing graduate programs
- Establish undergraduate training and internships
- Create high-school outreach program to increase the number of minority scientists studying Computational Biology



SA 3: Fellowships

- Establish graduate and post-doctoral fellowships in Computational Biology
  - "Funds to support this will be provided by the matching dollars provided by UCLA"
- Establish selection committee & evaluation criteria for awarding fellowships
- Begin recruitment & advertising

SA 4: Visiting Scholars Program

- CCB faculty will invite visiting scholars
- Establish mechanism to apply to be visiting scholar
  - Visits ranging from 2-3 days to 2-3 months
  - How much funding is available and when does it start?
  - Can other cores provide financial support for visiting scholars?
- Advertising & recruitment

SA 5: Coordinate Workshops, Retreats & Tutorials

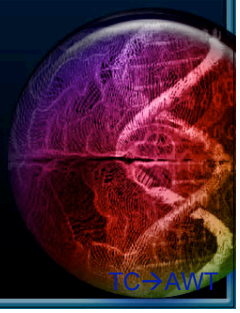
- Coordinate seminars on topics related to imaging-based Computational Biology
- Organize annual CCB retreat
- Organize a summer school on the Mathematics of Brain Imaging

Mathematics of Brain Imaging (Summer School)

- Combined sponsorship with IPAM and Johns Hopkins
- Attendance
  - CCB will invite selected speakers
  - approx 200 attendees
- Planned for mid-June, 2006
- Distribution:
  - Journal Special Issues
  - Presentations on CD/DVD and CCB web page

SA 6: Education materials

- Online tutorials and other training materials
- Technical white papers on CCB technology/tools
- Journal special issues
  - E.g., *NeuroImage*
- Web pages



CCB Overall Organization Core 6: Dissemination

Core 1: Computational Science
Registration
Shape Modeling
Param/Implicit Surfaces
Segmentation

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Analysis
Data Integration
Knowledge Management

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Brain Development
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Multiple Sclerosis
Schizophrenia

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Publications
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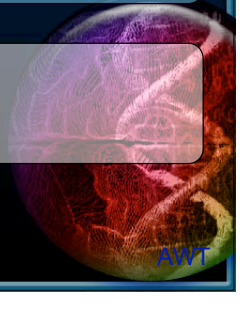
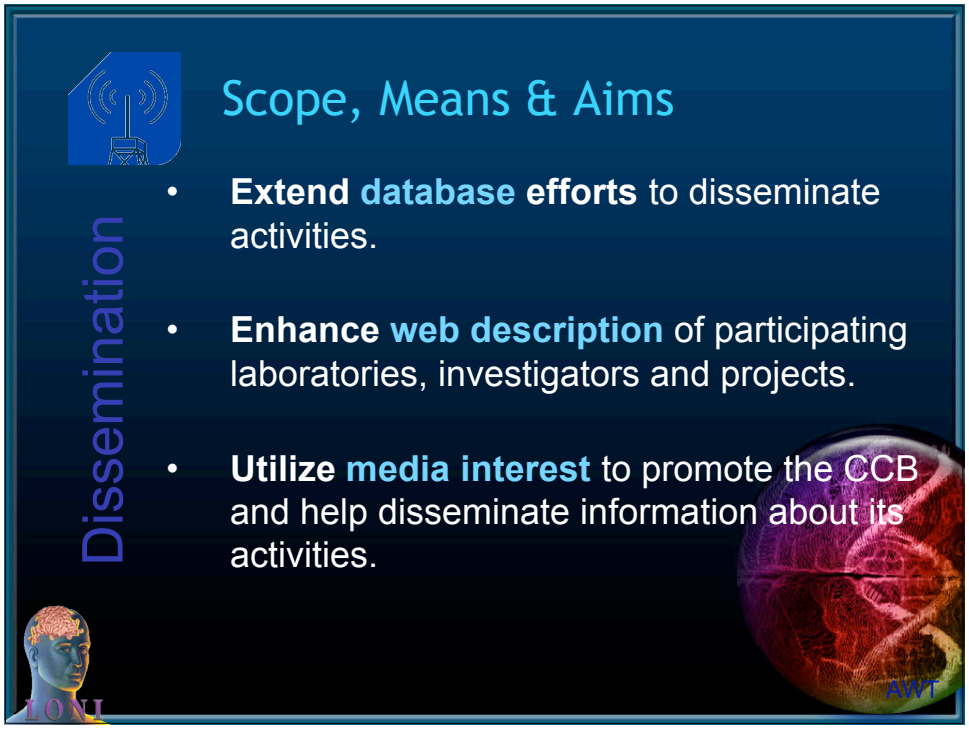
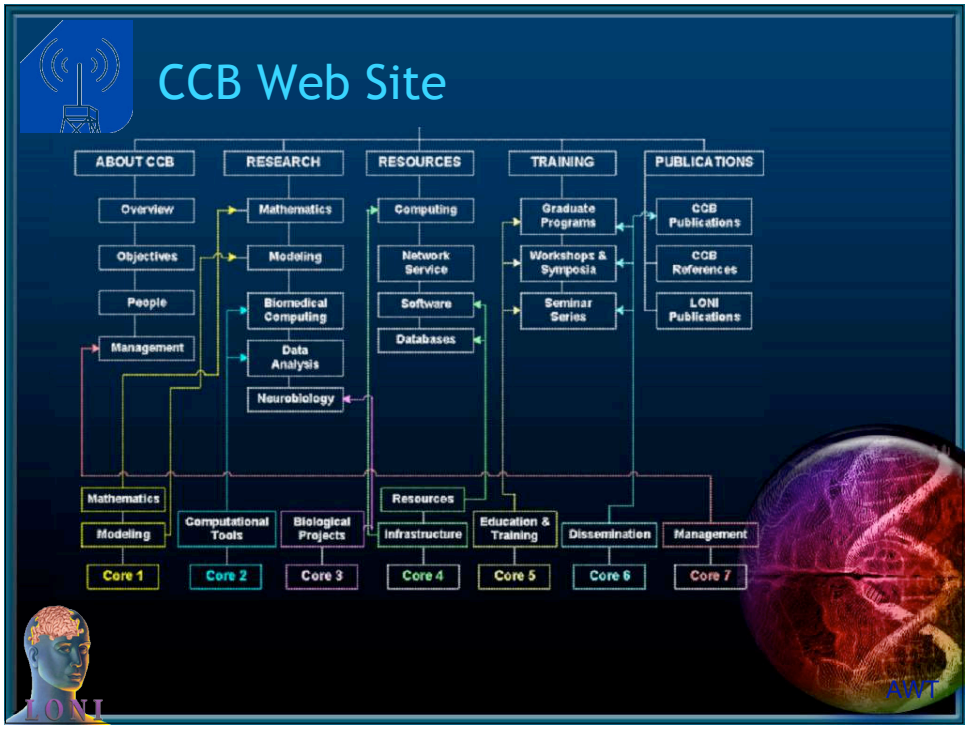
Database

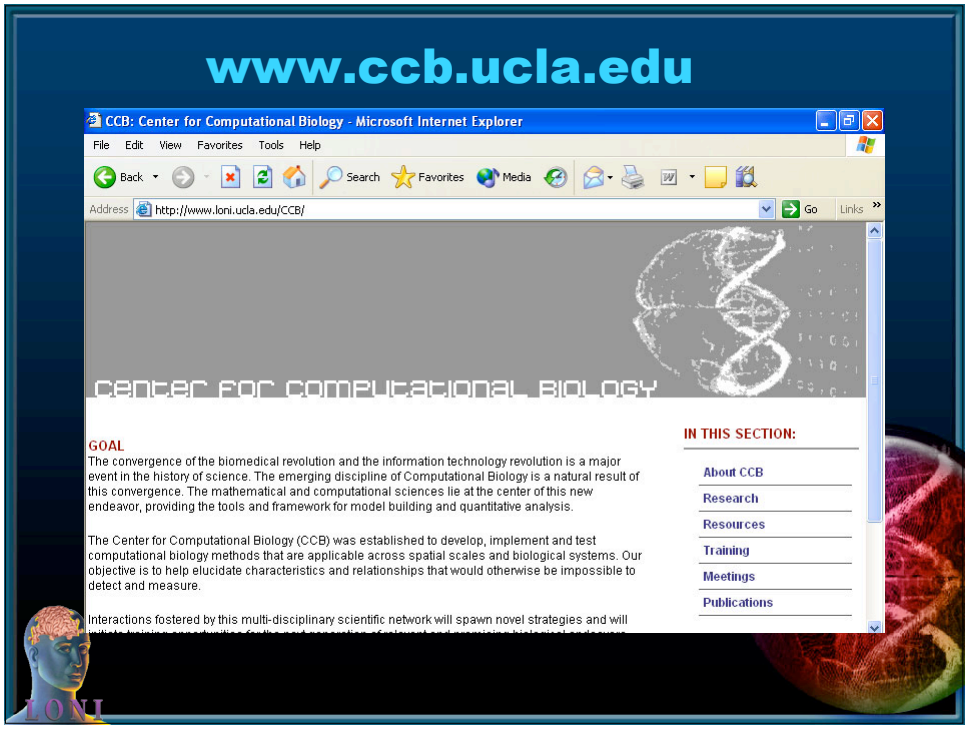
Core 7: Administration & Management
Committees
Science Advisory Board
Meetings & Communication
Progress & Monitoring
Support

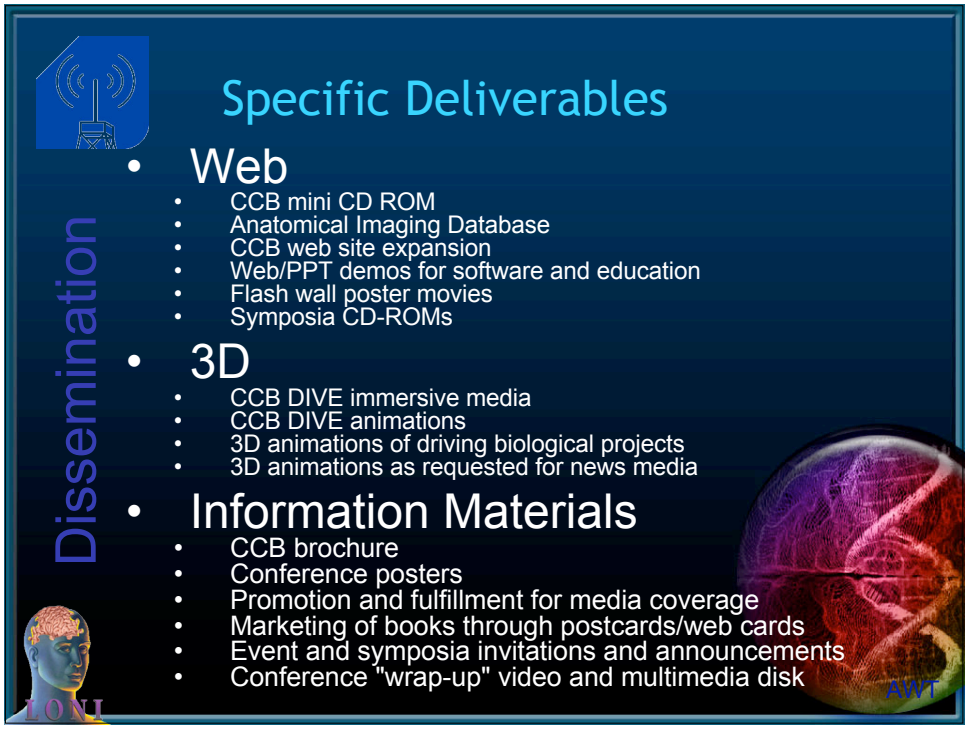


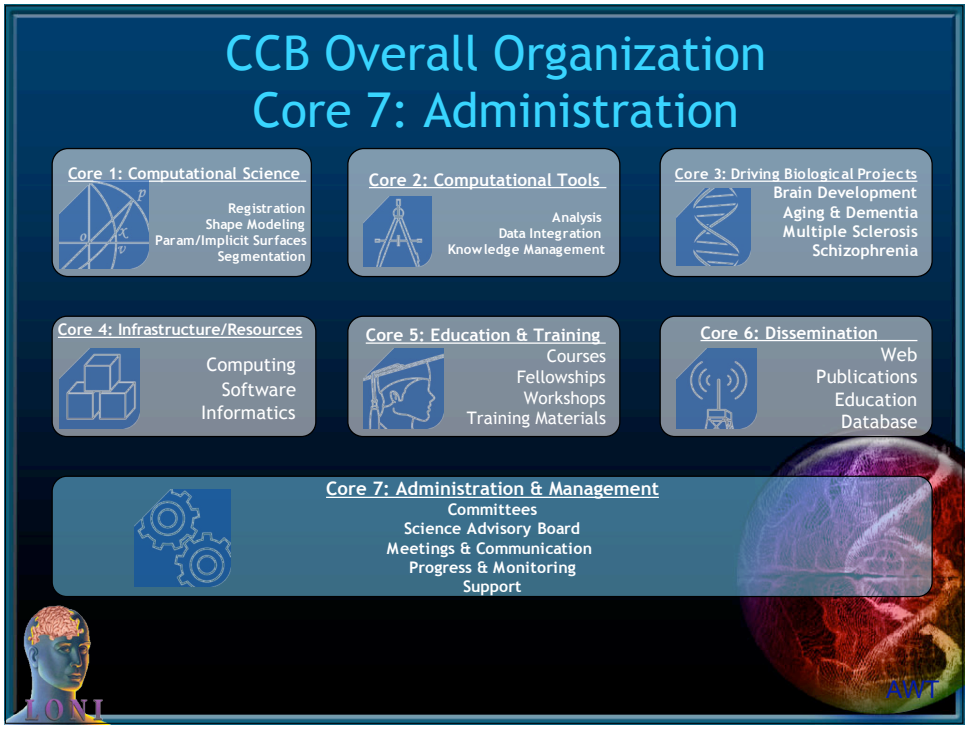

Scope, Means & Aims
Dissemination
• Expand workshop and symposia activities as a vehicle for formal dissemination.
• Design curricula and materials (see Core 5) and adapt them for wider distribution outside UCLA.
• Develop publication materials in the form of books, special issues in high profile journals and review articles.
• Create unique materials and illustrations (e.g., interactive visualization).
LONI
AWT


Scope, Means & Aims
Dissemination
• Extend database efforts to disseminate activities.
• Enhance web description of participating laboratories, investigators and projects.
• Utilize media interest to promote the CCB and help disseminate information about its activities.
LONI
AWT


CCB Web Site
ABOUT CCB
RESEARCH
RESOURCES
TRAINING
PUBLICATIONS
Overview
Objectives
People
Management
Mathematics
Modeling
Biomedical Computing
Data Analysis
Neurobiology
Computing
Network Service
Software
Databases
Graduate Programs
Workshops & Symposia
Seminar Series
CCB Publications
CCB References
LONI Publications
Mathematics
Modeling
Computational Tools
Biological Projects
Resources
Infrastructure
Education & Training
Dissemination
Management
Core 1
Core 2
Core 3
Core 4
Core 5
Core 6
Core 7
LONI
AWT


www.ccb.ucla.edu
CCB: Center for Computational Biology - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.loni.ucla.edu/CCB/
Go Links
Center for Computational Biology
GOAL
The convergence of the biomedical revolution and the information technology revolution is a major event in the history of science. The emerging discipline of Computational Biology is a natural result of this convergence. The mathematical and computational sciences lie at the center of this new endeavor, providing the tools and framework for model building and quantitative analysis.
The Center for Computational Biology (CCB) was established to develop, implement and test computational biology methods that are applicable across spatial scales and biological systems. Our objective is to help elucidate characteristics and relationships that would otherwise be impossible to detect and measure.
Interactions fostered by this multi-disciplinary scientific network will spawn novel strategies and will
IN THIS SECTION:
About CCB
Research
Resources
Training
Meetings
Publications
LONI


Specific Deliverables
Dissemination
Web
CCB mini CD ROM
Anatomical Imaging Database
CCB web site expansion
Web/PPT demos for software and education
Flash wall poster movies
Symposia CD-ROMs
3D
CCB DIVE immersive media
CCB DIVE animations
3D animations of driving biological projects
3D animations as requested for news media
Information Materials
CCB brochure
Conference posters
Promotion and fulfillment for media coverage
Marketing of books through postcards/web cards
Event and symposia invitations and announcements
Conference "wrap-up" video and multimedia disk
LONI
AWT


CCB Overall Organization
Core 7: Administration
Core 1: Computational Science
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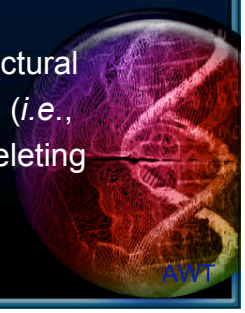
Support
LONI
AWT

Core 7: Administration & Management

Administration

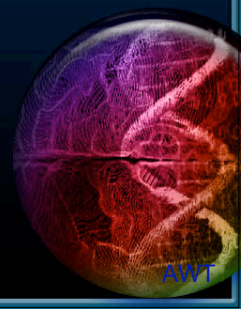
- **Facilitate info exchange** between projects, faculty, training programs and institutional entities;
- **Ensure that** physical and human **resources are utilized** to their maximum advantage throughout the program;
- **Monitor and adjust,** as needed, structural and functional aspects of the program (*i.e.*, committee memberships, adding or deleting workshops, etc.);



Core 7: Administration & Management

Administration

- **Establish operational mechanisms** for the program such as meetings, budgetary control and programmatic reporting;
- **Establish outreach mechanisms** and commercial relationships.
- **Coordinate public relations**.



CCB Communication & Monitoring

Committee/Group Name	Chair	Members
All-Hands	Toga / Dinov	All CCB Members
Scientific Projects	Thompson	Thompson, Shattuck, Dinov, Toga, Sowell, Voskuhl, Cannon
External Advisory Board	TBN	TBN
Infrastructure, Web, Systems & Technology	Valentino	Wang, Dinov, Neu, Magsipoc, Parker, Pan, Shattuck, Vese, Hammond, Capetillo-Cunife
Modeling and Visualization	Shattuck	Heng, Dinov, Shin, Zhang, Pan, Hammond, Wang, Parker
Mathematics and Computer Science	Osher	Soatto, Vese, Dinov, Lee, Parker, Shattuck, Thompson, Wang, Chan
Product Development	Valentino	Wang, Dinov, Neu, Magsipoc, Parker, Pan, Shattuck, Vese, Zhang, Xu
PR, Media and Outreach	Toga	Shattuck, Dinov, Thompson, Chan
HR and Recruitment	Toga	Shattuck, Dinov, Thompson, Chan
Edication and Training	Chan	Thompson, Valentino, Vese, Dinov, Toga

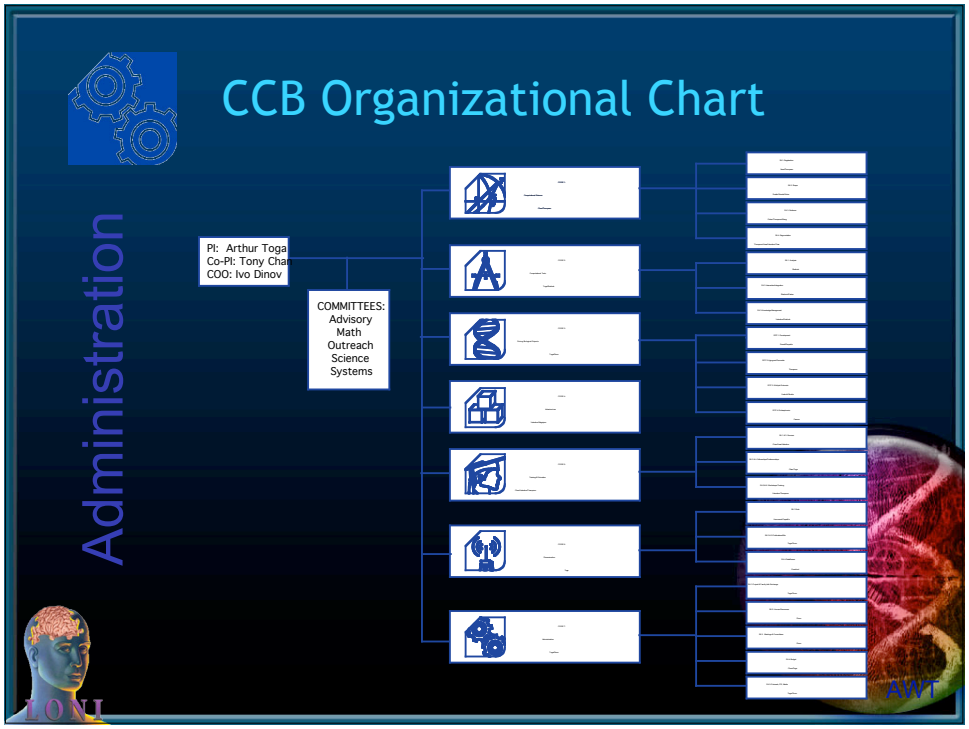
LONI AWT

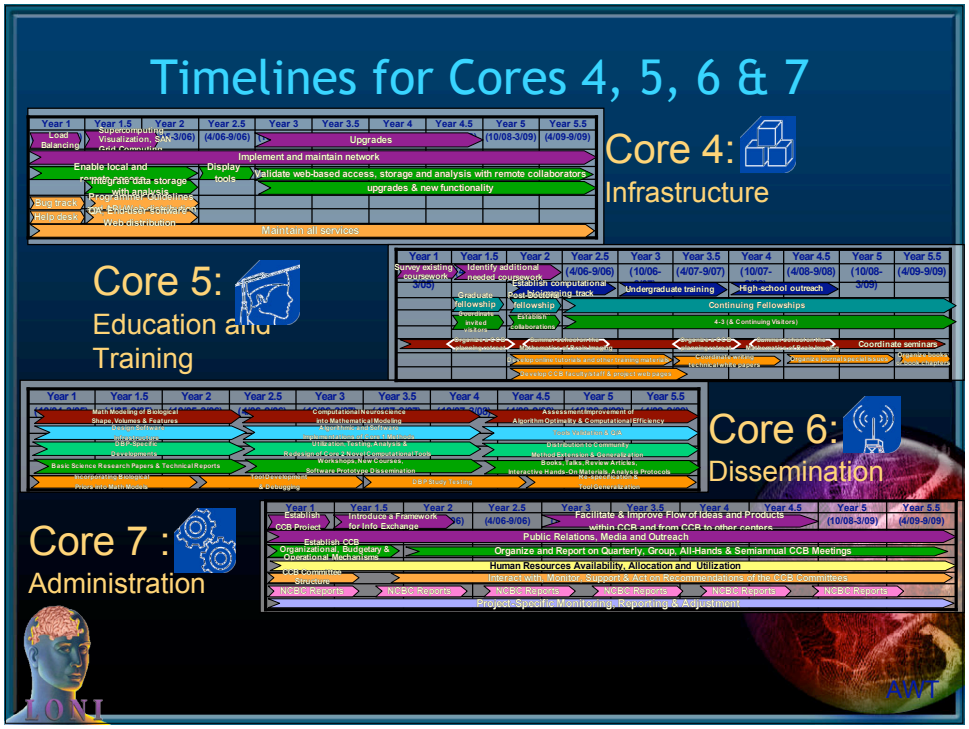
CCB Committee Work & Monitoring

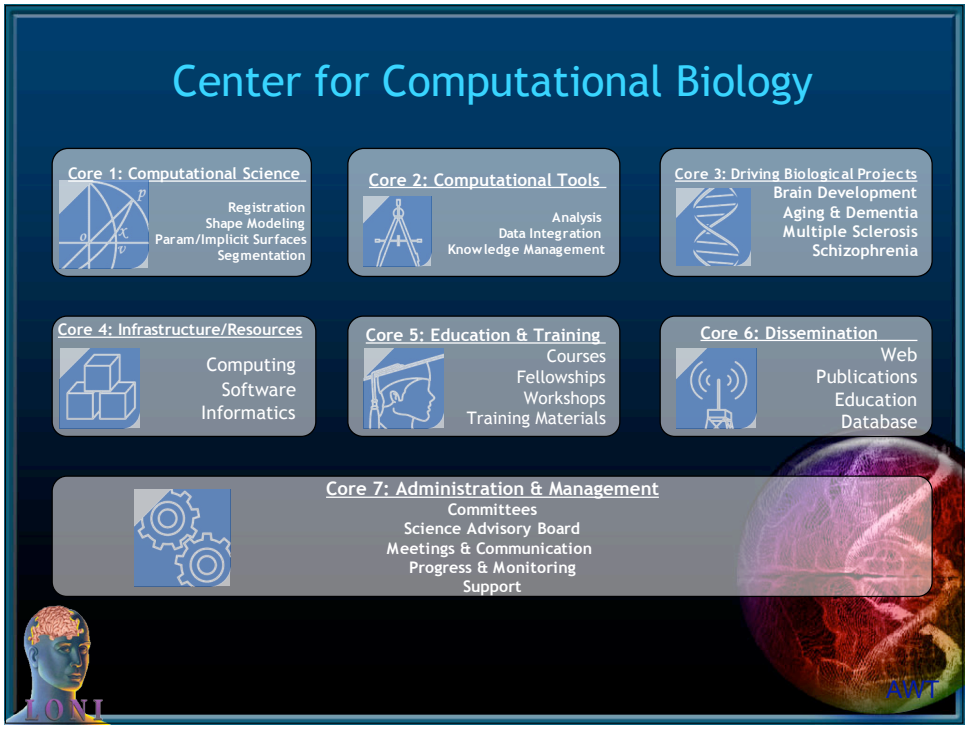
Committee/Group Name	Oct-04	Nov-04	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05
All-Hands												
Scientific Projects												
External Advisory Board												
Infrastructure, Web, Systems & Technology												
Modeling and Visualization												
Mathematics and Computer Science												
Product Development												
PR, Media and Outreach												
HR and Recruitment												
Edication and Training												

Meeting	
Conference Call	
Forum/Bulletin Board Discussion	
Tracking	
Written Report or Demo	
Completed/Delivered	
Status Normal	
Status Behind	

LONI AWT


CCB Organizational Chart
Administration
PI: Arthur Toga
Co-PI: Tony Chan
COO: Ivo Dinov
COMMITTEES:
Advisory
Math
Outreach
Science
Systems
LONI
AWT


Timelines for Cores 4, 5, 6 & 7
Year 1
Year 1.5
Year 2
Year 2.5
Year 3
Year 3.5
Year 4
Year 4.5
Year 5
Year 5.5
Load Balancing
Supercomputing, Visualization, SAN
(4/06-9/06)
Upgrades
(10/08-3/09)
(4/09-9/09)
Implement and maintain network
Enable local and remote access
Display tools
Validate web-based access, storage and analysis with remote collaborators
Integrate data storage with analysis
upgrades & new functionality
Bug track
Help desk
Maintain all services
Core 4:
Infrastructure
Core 5:
Education and Training
Survey existing coursework
Identify additional needed coursework
Establish computational Post-Doctoral track
(10/06-
(4/07-9/07)
(10/07-
(4/08-9/08)
(10/08-3/09)
Undergraduate training
High-school outreach
Graduate Fellowship
Undergraduate Fellowship
Coordinate invited lectures
Establish collaborations
Continuing Fellowships
4-3 (& Continuing Visitors)
Coordinate seminars
Core 6:
Dissemination
Core 7 :
Administration
Establish CCB Project
Introduce a Framework for info Exchange
Facilitate & Improves Flow of Ideas and Products within CCB and from CCB to other centers
Public Relations, Media and Outreach
Establish CCB Organizational, Budgetary & Operational Mechanisms
Organize and Report on Quarterly, Group, All-Hands & Semiannual CCB Meetings
Human Resources Availability, Allocation and Utilization
CCB Committee Structure
Interface with, Monitor, Support & Action Recommendations of the CCB Committees
NCBC Reports
Project Specific Monitoring, Reporting & Adjustment
LONI
AWT


Center for Computational Biology
Core 1: Computational Science
Registration
Shape Modeling
Param/Implicit Surfaces
Segmentation
Core 2: Computational Tools
Analysis
Data Integration
Knowledge Management
Core 3: Driving Biological Projects
Brain Development
Aging & Dementia
Multiple Sclerosis
Schizophrenia
Core 4: Infrastructure/Resources
Computing
Software
Informatics
Core 5: Education & Training
Courses
Fellowships
Workshops
Training Materials
Core 6: Dissemination
Web
Publications
Education
Database
Core 7: Administration & Management
Committees
Science Advisory Board
Meetings & Communication
Progress & Monitoring
Support
LONI
AWT